ATTACHMENT C

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Daniel Watson **Group Art Unit: 1775**

Serial Number: 10/783,934 **Examiner: Miller, Daniel H**

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For: Thermally Treated Carbide Material **Attorney Docket Number: 1157.06**

Commissioner for Patents
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AFFIDAVIT OF DANIEL WATSON

1. I, Daniel Watson, having an address at 350 Jennifer Lane, Driftwood, TX, am over the age of twenty-one years and am fully competent to make the following affidavit. I have personal knowledge of the statements made herein. I avow that these statements are true and correct.

2. I am the founder of Angel Swords located in Driftwood, Texas, a corporation that focuses on forging and selling high quality swords. I founded the company in 1979. We are the oldest and largest sword making company in the United States.

3. My education consists of a four year apprenticeship in traditional swordsmanship and traditional Japanese swordsmanship with Yoshindo Yoshihara. My swords have won at least 4 world championships for cutting tatami mats in excess of 14 mats, which was a previous record, when most swords can only cut 8 mats.

4. I have over 20 years of sword making experience including being a lecturer for the American Blade at the International Blade show and for the American Bladesmith Society. I have also consulted with Lockheed Martin concerning metallurgy during the development of their Joint

Strike Fighter Jet. Additionally my metallurgy processes have been used on drill bits, and other carbide based drilling equipment used in the drilling for oil or water.

5. I further attest as follows:

6. All of the individual particles that make up the carbide material are placed into their most stable state. These particles then are aligned optimally with surrounding particles. Also, molecular bonds are strengthened by the process.

7. The extreme cold temperatures during cryogenic processing also slow movement at the atomic level, increasing internal molecular bonding energy and promoting a pure structural balance throughout the material. The end result is a material with an extremely uniform, refined and dense microstructure with vastly improved properties.

8. The following is data from testing performed at our facility using the same starting material for each test. The test items were HT/HP tungsten carbide end mills, 3/16" diameter and 1 3/4 " overall. These were subjected to different cryogenic cold temperature and different heating temperatures. Each sample essentially was a carbide material treated according the *Cerutti* method, as the starting material. Then each sample was first cooled to the first indicated temperature, then heated to the heating temperature then cooled to the second indicated temperature, then heated to the heating temperature then cooled a third time to the third indicated temperature then allowed to warm up. Upon completion of the treating process, the carbide material was tested via number of holes drilled in hardened S7 tool steel, until failure. Uniform spindle speed and feed rate were used in all tests.

Percent Increase in Wear Resistance After Cryogenic Processing					
Sample Number	Cryo. Temp Used	Heating Temp	# of Holes Drilled	Total #	Difference Between Highest # of Holes Dilled and Lowest
1	-120/-120/-120	Zero F	17, 12, 2	31	15
2	-120/-120/-120	+700	15, 18, 29	62	14
3	-120/-120/-120	+1400	22, 24, 27	73	5

4	-380/-380/-380	0	9,34, 12	55	25
5	-380/-380/-380	+700	31, 23, 26	90	8
6	-380/-380/-380	+1400	28, 24, 25	77	4
7	-280/-220/-180	0	18, 7, 21	46	14
8	-280/-220/-180	+700	27, 32, 29	88	5
9	-280/-220/-180	+1400	27, 18, 33	78	15
10	Cerutti material		3, 11, 6	20	8

9. The following is data from testing performed with an independent driller using the same starting material for each test. The test items were a 7-inch carbide drag bit. The industry standard for these bits as used in Edwards Plateau limestone is 200 ft to 600 ft before it needs to be replaced. Below is data obtained from an independent contractor for a standard bit, a standard bit with a single cryogenic process and triple temper (*Brunson* method) and a standard bit that was done with the Angelsword method of a therma-cycle. Using the Angelsword method each sample was first cooled to the first indicated temperature, then heated to the heating temperature then cooled to the second indicated temperature, then heated to the heating temperature then cooled a third time to the third indicated temperature then allowed to warm up. The cooled temperature ranges ranged from -120 degrees F and -380 degrees F with a temperature rate of change ranging from 0.25 degrees F per minute and 20 degrees F per minute. The heated temperature ranged from 0 degrees F to 1400 degrees F with a temperature rate of change ranging from 0.25 degrees F per minute and 20 degrees F per minute.

Type of Bit	Test 1	Test 2	Test 3	Test 4	Maximum depth achieved
Standard bit	Drilled through 347 feet of soft rock. Failed by abrasion	Drilled through 153 feet of soft rock and 6 inches of hard rock. Failed by Abrasion.	Drilled through 420 feet of soft rock. Failed by Abrasion.	Drilled through 290 feet of soft rock and 1 foot of hard rock. Failed by Fracture.	420 feet
Standard bit with single cryogenic process and triple temper	Drilled through 580 feet of soft rock and 3 inches of hard rock. Failed by Fracture.	Drilled through 720 feet of soft rock and 1 foot of hard rock Failed by Fracture.			720 feet
Bit done with Angelsword method	Drilled through 4,200 feet of soft rock and 30 feet of hard rock. Failed by Fracture.	Drilled through 3,800 feet of soft rock and 18 feet of hard rock. Failed by Abrasion.			4,200 feet

10. In addition to the above test results I hereby attest that if the cooling hold at the cryogenic temperature is for less than 2 hours, the carbide breaks due to inadequate penetration and stress cracking that occurs in the metal. If the heating hold time occurs for les than 15 minutes, the carbide shatters having acquired different stress from thermal variations across the material.

11. Additionally, using less than 2 hours of hold time at the cryogenic levels shows lower performance characteristics due to uneven penetration during the shorter time period causing additional stress and lowered performance. I attest I have tested between 800 and 1500 components of machining tools made of carbide over a period of time between 2003 and 2006 and observed these results.

12. Using a shorter hold time of 15 minutes for the elevated temperatures, I have observed uneven tempering which results in softening and a ductile surface with a more brittle core, which is the opposite of the desired effect from the process of the invention In fact, the item

tends to shatter, due to thermal variations that occur across the material in this shorter time period.

13. Too rapid a rate of a temperature change results in thermal shock and microcracking in the material surface. A benefit in the current rate of temperature change has been shown through experimentation, to be near 0.25 to 20 degrees per minute. Larger items require slower times while smaller items may be cooled more rapidly. Factor is a size rather than material, in order to allow internal equilibration of temperature.

14. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and forth that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

DANIEL WATSON